

DIETARY DIFFERENCES BETWEEN TWO GROUPS OF PHAYRE'S LANGUR *TRACHYPITHECUS PHAYREI* IN TRIPURA, INDIA: RESPONSES TO FOOD ABUNDANCE AND HUMAN DISTURBANCE¹

A. K. GUPTA²

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²Wildlife Institute of India, Faculty of Wildlife Sciences, Department of Population Management, Capture & Rehabilitation, P. O. Box 18, Chandrabani, Dehra Dun 248 006, Uttaranchal, India. Email: akg@wii.gov.in

Dietary differences were compared between two groups of Phayre's Langur (*Trachypithecus phayrei*), one each in Gumti and Sepahijala Wildlife Sanctuary, Tripura, northeast India. In Gumti Wildlife Sanctuary (GWLS), out of 19 food species used by the group, just 5 accounted for more than 75% of the total feeding time, while in Sepahijala Wildlife Sanctuary (SWLS), 16 out of 67 food species accounted for almost the same feeding time. Out of twelve common food species in both the sanctuaries, some were used more frequently in GWLS than in SWLS, and *vice versa*, e.g. *Albizia procera* was a highly preferred food species in Gumti than in Sepahijala. Feeding on young foliage was almost the same for both the groups. In GWLS, the langur ate more seeds (23.2%) and a little unripe fruit (5.3%), while in SWLS, it ate more unripe fruit (17.6%) and spent equal durations of time feeding on seeds (6.0%) and mature foliage (5.8%). Differences in food abundance and availability, and variations in the nature and intensity of human disturbance have been identified as some of the possible reasons for the dietary differences in the two groups. This study highlights the need for species- and area-specific conservation strategies, based on detailed information on specific ecological needs of adjacent populations of any given indicator/ flagship wildlife species.

Key words: Phayre's Langur, *Trachypithecus phayrei*, Tripura, feeding ecology, human disturbance, learnt cultural traditions

INTRODUCTION

Dietary differences among neighbouring populations of the same primate species could be more than simply a measure of the presence or absence of specific food items from their home ranges (Chapman and Fedigan 1990). Richards (1977) noted that one population of *Propithecus verreauxi* fed extensively on one specific food item, whereas another population totally ignored it, although the abundance of that item was almost same. Schlichte (1978) observed that differences in the feeding behaviour may be dependent not only on the density of the plant species, but also on the composition of the vegetation as a whole. Dietary differences have also been explained in terms of: environmental differences and/or primate cultural traditions (Kummer 1971; McGrew 1983, Richards 1985); human disturbance (Nishida *et al.* 1983); role of phytochemistry and secondary compounds in food selection (Freeland and Janzen 1974; Oates *et al.* 1977; Waterman and Choo 1981; Mowry *et al.* 1996); and food profitability in terms of nutrients, energy value and availability (Chapman and Fedigan 1990).

In this paper, I examine the dietary differences between two groups of Phayre's Langur (*Trachypithecus phayrei*), in relation to variations in food abundance; human disturbance and cultural traditions.

METHODS

Study animal

Phayre's Langur *Trachypithecus phayrei* (= *Presbytis*

phayrei), belongs to Family Colobidae. Since the last review on the taxonomic status of this species by Agrawal (1974), confusion has persisted as it is referred to by different names: *Presbytis phayrei*, *P. barbei* and *Trachypithecus phayrei*. Gupta (1998) reviewed its taxonomic status and recommended the use of Phayre's Langur *Trachypithecus phayrei phayrei* as the common and scientific names for this species. The species is reported in Bangladesh, India, Myanmar, China, Thailand, Laos and Vietnam. The western and eastern limits of this species are Bangladesh (24° 30' N, 90° 10' E) and North Vietnam (20° 19' N, 105° 38' E) while its northern and southern limits are China (25° N, 98° 45' E) and Thailand (14° 41' N, 98° 52' E) respectively. In India, Tripura has the largest population (Gupta 1994) of this species, which was also reported from Assam (Choudhury 1986) and Mizoram (Mishra *et al.* unpublished report).

Study sites and Study groups

The study was conducted in Gumti (23° 21'-23° 40' N; 91° 57' E) and Sepahijala (23° 38'-23° 42' N; 91° 17'-91° 22' E) wildlife sanctuaries separated by about 100 km (Fig. 1).

Gumti Wildlife Sanctuary: Gumti (389.5 sq. km) receives annual rainfall of about 150 cm; its minimum and maximum temperatures are c. 4 °C and 38 °C respectively. Mean altitude varies between 150-380 m above msl. The study site was a secondary forest patch (68 ha) of about 15 years' regeneration growth, due to shifting cultivation (*jhum*), located at Mukhchheri, about 16 km from the Sanctuary headquarters at Jatanbari. *Jhum* was a major human disturbance. The forest types are Evergreen and Moist, Mixed Semi-Evergreen and

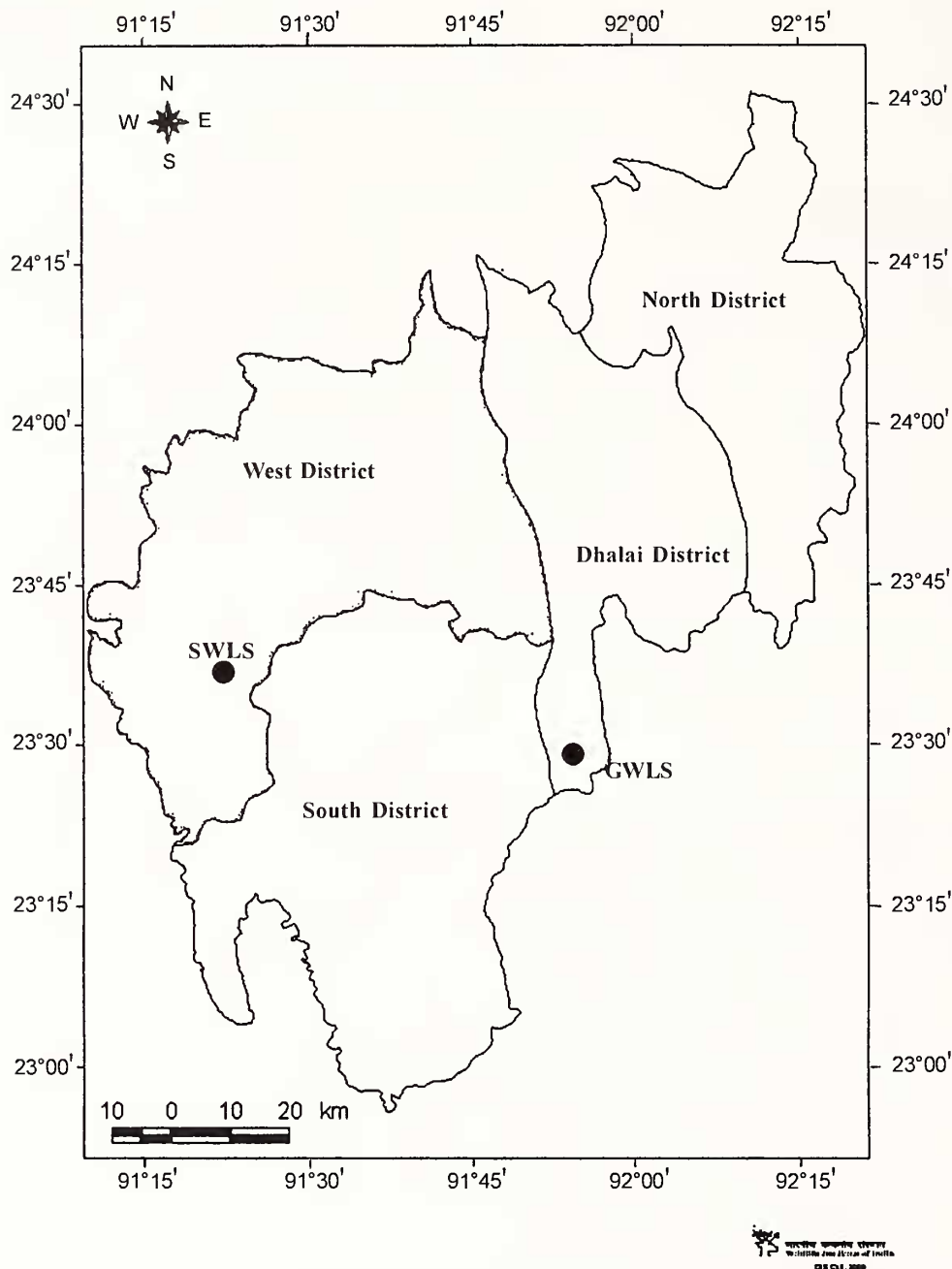


Fig. 1: Map of Tripura, northeast India, showing location of Gumti and Sepahijala Wildlife Sanctuaries

Deciduous. Main plant species included large stands of *Lagerstroemia parviflora*, *L. flos-reginae*, *Albizia procera*, *A. stipulata*, *A. lebbek*, *Bursera serrata*, *Gmelina arborea*, *Eugenia jambolina*, *Salmalia malabarica*, besides bamboo (*Melocanna bambusoides*), thatch (*Imperata cylindrica*), *Mikania scandens*, *Holarrhena antidysentrica*, and *Eupatorium* sp. The middle and lower canopy was a coppice of fire-hardy secondary forest species. A total of 17 groups of Phayre's Langur were present in Gumti, of which five were

within the study area. One of these was selected for an intensive ecological study. During the study period, this group (referred to as Group-G) consisted of 18 individuals: 1 adult male, 5 adult females, 9 sub-adults, 2 infants, and 1 new born. Other primate species in the study area were: Capped Langur (*Trachypithecus pileatus*), Hoolock Gibbon (*Hylobates hoolock*), Slow Loris (*Nycticebus coucang*), Rhesus Macaque (*Macaca mulatta*), Stump-tailed Macaque (*M. arctoides*) and Pig-tailed Macaque (*M. nemestrina*).

Sepahijala Wildlife Sanctuary: The annual rainfall (120 cm) of Sepahijala Wildlife Sanctuary (18.5 sq. km) is less than Gumti WLS, but its minimum and maximum range of temperatures are similar to Gumti. Mean altitude varies between 20-40 m above msl. The study area is a Reserved Forest (69 ha) consisting mainly of Semi-evergreen forest: *Terminalia belerica*, *T. chebula*, *Gmelina arborea*, *Albizia stipulata*, *Dillenia pentagyna*, *Ficus racemosa*, *F. fistulosa*, *F. hispida*, *Syzygium fruticosum*, *Artocarpus chaplasha*, *Salmaia malabarica*, and *Schima wallichii* among others. It was noted that *Ficus* trees were well represented, mainly because *jhum* was almost absent in this area.

The study area here differed from Gumti in the presence of forestry plantation patches. These plantations (about 9 ha) of native and exotic tree species (*Tectona grandis*, *Acacia auriculiformis*, *Adenanthera pavonina*, *Delonix regia*, *Hevea brasiliensis*, were raised in the early 1980s to restore the forest which had been degraded due to heavy biotic pressure (largely for collection of forest products, livestock grazing and cultivation) from 17 villages located in and around this area.

The food plant species diversity used by the langurs here is 41 species/ha (almost twice than at GWLS) although estimated tree density is marginally less at 250 trees/ha (Gupta 1996).

Sepahijala had 17 groups of Phayre's Langur, of which four were within the study area. The study group (Group-S) consisted of 7 individuals (1 adult male, 3 adult females, 1 sub-adult and 2 infants) at the beginning of the study, which increased to 11 individuals (3 adult males, 3 adult females, 1 sub-adult, 2 infants and 2 new born) at the end of the study period following immigration and new births. Other primate species in the area were Capped Langur, Rhesus Macaque,

Pig-tailed Macaque and Slow Loris. One group of Golden Langur (*Trachypithecus geei*) introduced in this Sanctuary was also present (Gupta and Mukherjee 1994). Hoolock Gibbon and Stump-tailed Macaque were absent.

Ecological and behavioural observations

Ecological and behavioural data on Group-G were collected for seven months from November 1989 to June 1990. Data on Group-S were collected for one complete year from November 1993 to October 1994, but only 8 months (Nov.-Jun) data have been used in this paper.

An initial period of about three months was spent surveying, mapping and habituating the selected study animal groups before undertaking intensive studies at both sites.

Vegetation Sampling

In Gumti WLS, trees ≥ 20 cm girth at breast height (gbh) were enumerated from 10 random sample plots, each 50 x 50 m, covering about 9% of home range of the study group (27.8 ha). In Sepahijala WLS, 12 strip transects were randomly laid within the home range of Group-S covering about 62% of the home range (20.3 ha). The width of each strip was fixed at 40 m while the length varied between 75 m and 525 m.

The group-scan method (Altmann 1974) was used at both sites to collect data on dietary patterns and other activities. The study group was scanned for 5 consecutive days in each month and an interval of 15 minutes was maintained between two consecutive scans. A total of 14,186 and 15,818 records were made in eight months in Gumti WLS and Sepahijala WLS, respectively. Percent time spent feeding was estimated from: $T = (n_f \times 100)/N$, where T = % daytime spent feeding, n_f = number of records that included feeding, and N = total number of records for the day.

RESULTS

Group-G spent 34.9% (range = 30.6-42.2%) and Group-S spent 38.5% (range = 32.7-42.6%) of the total activity time feeding (Fig. 2). There was significant difference between both the groups in the feeding time (pair test, $N=8$, $Z=-2.1$, $p=0.036$) and number of food species consumed annually: Group-G 18 food species (range 5-10) and Group-S 67 food species (range 18-28) (Fig. 3).

The groups also differed in the number of food species contributing more than 1% of total feeding time [15 species contributed 78.9% of feeding time in Group-G, while 23 species contributed 34.3% in Group-S]. Together, 31 species contributed more than 1% of total feeding time, of which 8 species were exclusive to Group-G, 16 to Group-S, and 7 were common to both groups. A significant positive correlation

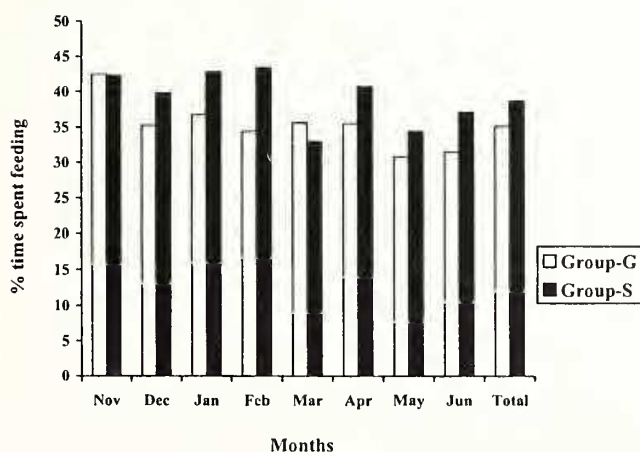


Fig. 2: Percent time spent feeding by Group-G and Group-S of Phayre's langur (*Trachypithecus phayrei*) in Gumti and Sepahijala Wildlife Sanctuary

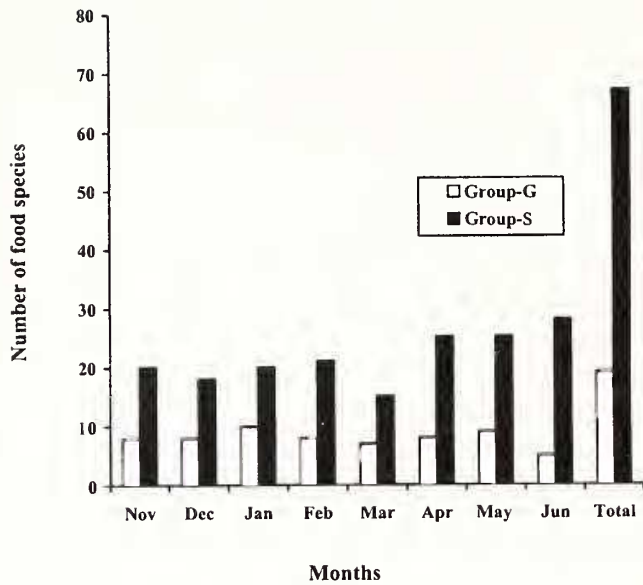


Fig. 3: Number of food plant species used by Group-G and Group-S

existed between time spent feeding and availability of most food species in their respective home range ($r_s = 0.747$, $p < 0.001$ for Group-G and $r_s = 0.82$, $p < 0.001$ for Group-S). Thus, both groups differed in their use of the seven common food species according to the abundance of the food species (Table 1).

Top-ten food species

In Group-G and Group-S, the top-ten food species accounted for 87.8% and 59.1% of total feeding time, respectively. Only one species (*Mikania scandens*) was common to both groups (Table 1). In Group-G, preference for top-ten food species was in accordance with their abundance ($r_s = 0.729$, $p < 0.05$), but not so in Group-S ($r_s = 0.309$, $p > 0.1$).

The two groups also differed in the maximum feeding time spent on a single food species: Group-G on *Albizzia procera* (27.8%) and Group-S on *Ficus racemosa* (7.6%).

Both groups spent almost the same time feeding on young foliage (about 48%), but differed in the use of other plant parts. Second to young foliage, Group-G preferred seeds (23.2%) and Group-S unripe fruit (17.6%). Group-S spent almost equal durations on mature leaves (5.8%) and seeds (6%) (Fig. 4).

Furthermore, the two groups differed in their use of feeding substratum. Group-G never descended to the ground for feeding, while Group-S spent about 7.3% of the total feeding time on the ground, feeding on germinating seeds and ripe fruit (Gupta 1996). Both the groups also differed in their animal diet; it was higher for Group-S (0.05%) than for Group-G (0.01%).

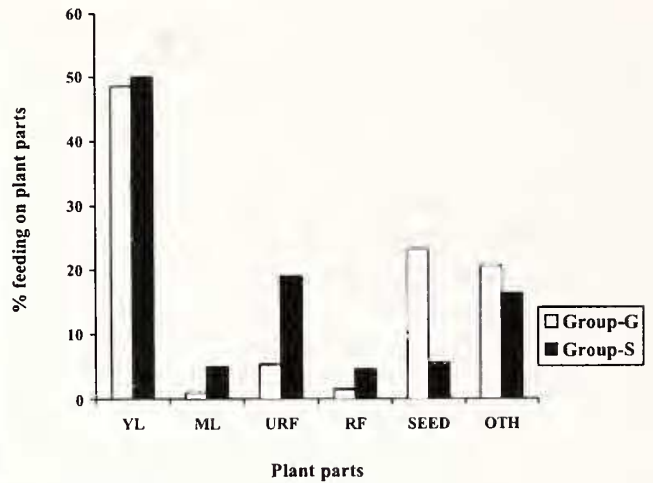


Fig. 4: Percent time spent feeding on different plant parts by Group-G and Group-S

The soil is poor and acidic due to repeated *jhum* once in 2 to 3 years. The density of *Ficus* species was low in the repeated *jhum* areas compared to non-*jhum* areas (Gupta 1996). The estimated tree density was 280 trees/ha, but the diversity of food trees used by the Langur was relatively low at 22 species/ha (Gupta and Kumar 1994).

DISCUSSION

Abundance of food plants

Although there was a correlation between abundance and percentage time spent feeding, the selection of any particular food species by both groups was not simply a function of abundance.

One such case is the use of *Albizzia procera*. In Gumti, *A. procera* was less abundant (20 trees/ha) than *C. arborea* and moroi (*Albizzia lebbek*) (44 and 72 trees/ha, respectively), but was consumed more (27.9% mostly for seeds) than *C. arborea* (16.8%) and moroi (*Albizzia lebbek*) (1.5%). In contrast, *A. procera* was more abundant (2.2 trees/ha) in SWLS than at least five other top-ten food species (*Ficus racemosa*, *F. fistulosa*, *Syzygium fruticosum*, *Delonix regia* and *Dillenia pentagyna*), but its consumption was much less (almost negligible for seeds) than any of them. Group-S consumed the seeds of *Acacia auriculiformis* and *Delonix regia*, both less abundant than *A. procera*. This suggests that Group-G preferred *A. procera*, and Group-S preferred *A. auriculiformis* and *D. regia*.

Rudran (1978) studying two groups of Blue Monkeys (*Cercopithecus mitis stuhlmanni*) concluded that dietary differences between groups can be explained by differences in tree species' density in their home ranges, and by local variation in phenological activity of food plants. In this study,

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Table 1: Percentage time spent feeding and density of food species for Group-G and Group-S of Phayre's langur

Species	Group-G			Group-S		
	% Feeding	Density/ha	PI	% Feeding	Density/ha	PI
<i>Albizzia procera</i> *	27.8	20	1.9	-	-	-
<i>Melocanna bambusoides</i> *	18.3	nr	-	-	-	-
<i>Callicarpa arborea</i> *	16.3	44	1.0	-	-	-
<i>Litsea</i> sp. (medda)*	1.7	12	1.5	-	-	-
<i>Odina wodier</i>	1.3	16	0.1	-	-	-
<i>Albizzia lebbek</i> *	5.3	16	1.5	-	-	-
<i>Albizzia</i> sp. (moroi)	1.5	72	0.1	-	-	-
<i>Macaranga denticulata</i> *	1.7	16	1.5	-	-	-
<i>Albizzia stipulata</i> **	8.5	16	4.2	1.9	0.5	2.9
<i>Gmelina arborea</i> **	4.1	8	2.6	2.4	0.2	17.9
<i>Mikania scandens</i> **	2.1	nr	-	6.0	nr	-
<i>Dioscorea alata</i> **	2.1	nr	-	3.1	nr	-
<i>Ficus hispida</i> **	1.3	nr	-	6.7	9.7	3.0
<i>Ficus indica</i> **	0.9	16.0	0.9	4.3	2.4	1.7
<i>Terminalia bellerica</i> **	1.5	nr	-	2.0	6.8	0.4
<i>Gardenia turgida</i>	-	-	-	1.3	0.1	35.3
<i>Ficus fistulosa</i> *	-	-	-	7.4	0.4	21.9
<i>Ficus racemosa</i> *	-	-	-	7.6	0.2	14.7
<i>Syzygium fruticosum</i> *	-	-	-	5.8	0.4	13.4
<i>Delonix regia</i> *	-	-	-	5.6	0.5	9.8
<i>Streblus asper</i>	-	-	-	1.9	1.3	9.3
<i>Adenanthera pavonina</i>	-	-	-	3.6	0.9	6.0
<i>Artocarpus lakoocha</i>	-	-	-	3.9	2.2	0.7
<i>Stereospermum personatum</i>	-	-	-	1.2	0.4	4.0
<i>Swietenia mahogani</i>	-	-	-	2.5	2.2	2.8
<i>Dillenia pentagyna</i> *	-	-	-	4.0	2.2	1.6
<i>Hevea braziliensis</i>	-	-	-	2.2	4.5	1.2
<i>Acacia auriculiformis</i> *	-	-	-	6.7	18.7	0.9
<i>Artocarpus chaplasha</i> *	-	-	-	4.8	6.6	0.7
<i>Vitex peduncularis</i>	-	-	-	1.1	2.8	0.1
<i>Schima wallichii</i>	-	-	-	1.0	22.6	0.1

nr = not represented

* = Top-ten food species

** = 7 common food species for both groups

PI = Preference Index

however, differences in soil condition and other geographical variations did not have any effect on the productivity cycle (phenology) of different plant parts (Gupta and Kumar 1994; Gupta 1996) of *A. procera* flowering and fruiting normally at Gumti and Sepahijala.

Habitat disturbance and adaptability

Dietary differences in the two groups can also be attributed to the changes in the habitat following various types of human disturbances. Repeated *jhum* may lead to poor acidic soils (Ramakrishnan 1992) that could have been the case in Gumti WLS favouring leguminous trees (*A. procera*), which would result in more seed eating (23.2%). Recent studies on African colobines (Maisels *et al.* 1994;

Gartlan *et al.* 1986; Oates *et al.* 1990) have shown that (a) relative abundance of legumes increases with increasing soil poverty. Increasing abundance of legumes increases the availability of nutrient rich seeds, and hence there is more seed eating; (b) the seeds and young leaves of leguminous trees are frequently nutrient rich and among the preferred food of colobines, though legume species are often associated with nutrient-poor soil (Richards 1977).

No feeding by Group-S on *A. procera* seeds could be associated with their poor nutrient value in Sepahijala. The preference for seeds of *A. auriculiformis* and *D. regia* could be associated with differences in nutrient values vis-à-vis *A. procera*. However, a chemical analysis of *A. procera* seeds for their nutrient values, from both study sites, is a must for

comparison with the nutrient values of other food species (bamboo, *Callicarpa arborea* and *A. stipulata* in Gumti; and *Ficus racemosa*, *F. fistulosa*, *A. auriculiformis*, *F. hispida* in Sepahijala). Johns *et al.* (1978) showed that the levels of certain chemicals in plants differ among geographic localities, with the result that they are eaten more in some areas than in others. In addition, studies on Howler Monkeys (Glander 1981) and Spider Monkeys (Van Roosmalen 1982) have shown that the selection of individual food trees was associated with their intraspecific differences in nutrients and secondary compounds.

In Gumti, low plant diversity due to *jhum* restricted the choice of food plants for Group-G, which used only 19 food species. Of these, 5 species accounted for more than 75% feeding time, including one single species (*A. procera*) contributing 27.8% feeding time. In Sepahijala, *jhum* was absent and human disturbance was restricted to trespassing, collection of minor forest products, and illicit felling. As a measure to counter these disturbances, the natural forest patches were fortified with plantations (including *Acacia auriculiformis*, *Delonix regia*, *Gmelina arborea*, *Artocarpus lakoocha*, *A. chaplasha*, *Caesalpinia pulcherrima*, *Leucaena leucocephala* and *Adenanthera pavonina*) offering more choice of food items to Group-S (67 food species and no single species accounted for more than 8% of total feeding time).

CONCLUSION

Dietary differences between two groups of Phayre's Langur could be explained as a combined result of various factors. All these factors are inter-related and influence the dietary patterns of the langurs. Of the different factors discussed, adaptability of the langurs to the changes in their

respective habitats, however, appears to be the most important. Adaptability allowed Group-G and Group-S to survive under different habitat conditions. This adaptability hypothesis does provide information on preferences for specific food plant species by both the groups. Information on preferred food plant species by each group could be vital to wildlife managers, while selecting suitable plant species while undertaking gap or new plantations as wildlife habitat improvement measure.

Detailed knowledge on the feeding ecology of an animal species is one of the most important requirements for designing its conservation strategy. Based on the differences observed in the dietary patterns of two groups of Phayre's Langur in closely located Gumti and Sepahijala Wildlife Sanctuaries, the conservation strategy for this species will have to be specialized for a given habitat type. This may also hold good for other indicator wildlife species in closely located Protected Areas. It would, thus, be imperative for wildlife managers to opt for species- and area-specific ecological studies on key indicator/flagship wildlife species for effective planning and execution of suitable conservation strategies at microhabitat levels.

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